The Examiner's Anticipation Position

The Examiner's position seems to be that because the "resonance frequency of the [Adams] resonator is based upon the effective mechanical stiffness of the spring-mass mechanism" any "variations in the effective mechanical stiffness is compensated by proportional changes in the effective mechanical mass and also depends upon a ratio of width and height to provide substantial rigidity and stiffness of the spring-mass mechanism." (Action, page 3). As support for the anticipation rejection, the Examiner cites Adams, Col. 7, lines 33-59 and Figures 8 and 9. See below.

> The principles described with respect to FIGS. 6 and 7 are further illustrated in a resonator device 50 shown in top plan view in FIG. 8 and in a partial perspective view in FIG. 9. As there illustrated, the resonator consists of an elongated, movable beam 52 mounted at its ends 54 and 56 to corresponding support arms 58 and 60. These support arms extend laterally from the respective ends 54 and 56 and are connected at their outermost ends to a fixed base, which may be a substrate 62. The beam 52 is supported for with respect to base 62 motion along its longitudinal axis 63 in the direction of arrows 64, with support arms 58 and 60 being secured to hold the beam 52 in place and to constrain it to desired axial path. The support arms 58 and 60 have a high aspect ratio so they are flexible in the x-y plane in which beam 52 lies, and urge the beam 52 toward a neutral rest position when no external force is applied to the beam, to thereby serve as restoring springs for the device. The beam 52 and spring arm 58 and 60 are a micromechanical structure preferably having micron-scale dimensions. The beam 52 is also fabricated to have a high aspect ratio; i.e., with a height of 10–20μ and a width of about 0.5–3μ to provide substantial rigidity in the vertical direction. As illustrated in FIG. 9, the beam may be fabricated in a box configuration for rigidity, to enable it to withstand axial forces which produce beam motion with respect to the substrate. The movable structure has a natural resonant frequency, which is a function of its mass and of the flexibility of the spring arms, when a driving force is applied.

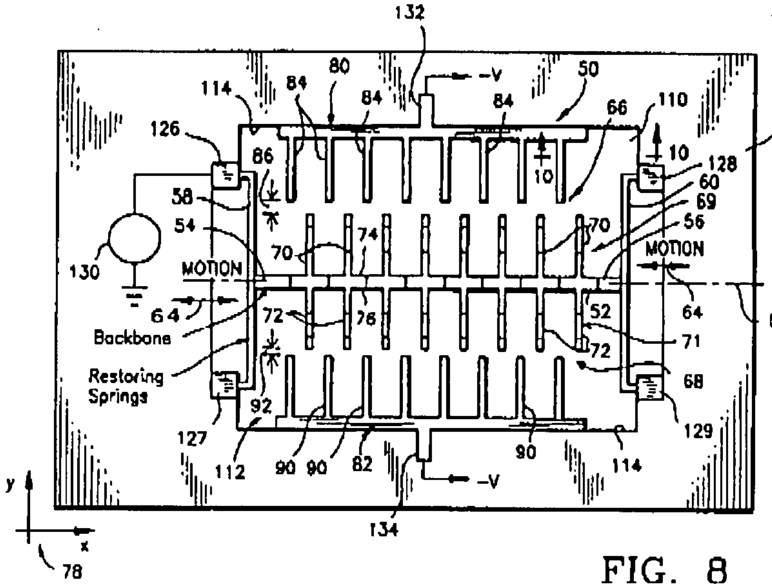

FIG. 8

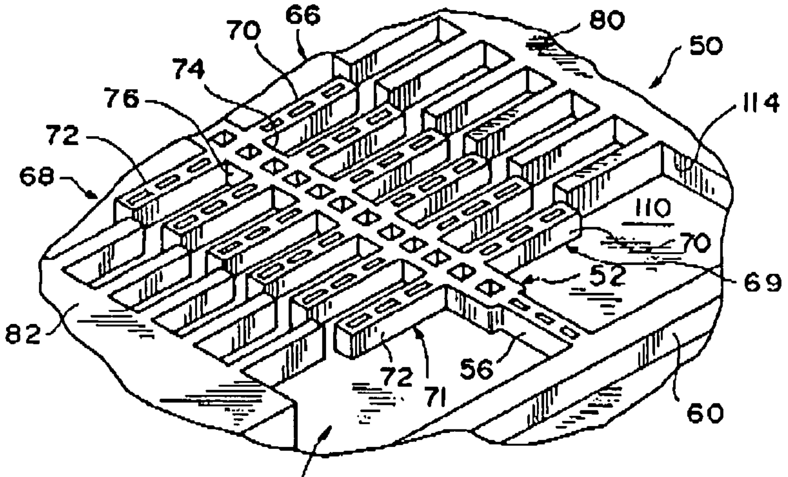

FIG. 9

First, there is no doubt that the resonance frequency of the resonator is based (at least in part) on the effective mechanical stiffness of the spring-mass mechanism. However, that is not tantamount to teaching or suggesting a geometry of the spring mass mechanism of Applicants' claimed microelectromechanical resonator. That is, nowhere does Adams teach or suggest (expressly or inherently) the features of independent claim 27, including:

- the geometry of the spring-mass mechanism and the effective mechanical mass of the spring-mass mechanism being simultaneously defined by application of a fabrication process to a constituent material;
- the geometry of the spring-mass mechanism being defined such that variations in the effective mechanical stiffness of the spring-mass mechanism are compensated by proportional changes in the effective mechanical mass of the spring-mass mechanism; and/or
- one or more variations of the fabrication process to the constituent material results in little change to a ratio defined by a change in the effective mechanical stiffness and a change in the effective mechanical mass.

The fact that Adams employs vents in the electrodes/beams to facilitate release of the moveable electrodes provides no support for defining the resonator geometry such that variations in the effective mechanical stiffness of the spring-mass mechanism are compensated for proportional changes in the effective mechanical mass of the spring-mass mechanism. Adams uses a SCREAM-I process to release certain portions of the mechanical structure. (Col. 8, line 64 to Col. 9, line 22 and Figures 9 and 10). In this regard, "[d]uring the undercutting step used in the SCREAM-I process to release the beams and the electrodes, the side walls are also undercut to produce a concavity 124." (Col. 9, lines 16-18 and Figure 10).

As Adams explains, to "compensate for variations that can occur in the fabrication process", Adams employs "electrostatic actuators which provide a mechanism for electromechanically increasing or decreasing the stiffness and thus the resonant frequency of" the Adams resonator. (Col. 1, lines 49-62). In one embodiment, a bias voltage between the electrodes 70 and 84 and between adjacent electrodes 72 and 90 tunes the resonant frequency of the mechanical system. (Col. 8, lines 51-56). In this regard,

> [a] bias voltage applied between adjacent electrodes 70 and 84 and between adjacent electrodes 72 and 90 can be used to control the relative motion of the beam 52 with respect to the stationary substrate 62 to thereby tune the resonant frequency of the mechanical system including beam 52 and support arms 58 and 60. A mechanical force may be applied to the beam 52 to initiate oscillatory motion of the beam, which motion can be supplied by a drive actuator, ... and the voltage applied to the actuators ... is used to adjust the resonant frequency of the system. (Col. 8, lines 51-61).

Adams neither teaches (expressly or inherently) to address resonance frequency variations by process-tolerance-induced fabrication errors, for example, process-tolerance-induced undercut errors, by employing a resonator geometry as claimed. Adams describes a resonator whose resonate frequency is corrected to compensate for variations that can occur in the fabrication process by adjusting the voltage applied to electrostatic actuators. Indeed, there is absolutely no discussion in Adams regarding employing a resonator geometry such that variations in the effective mechanical stiffness of the spring-mass mechanism are compensated for proportional changes in the effective mechanical mass of the spring-mass mechanism.

Claimed Inventions

There are many inventions described in the instant application. In an effort to present a more concise response, these remarks below will focus on only certain aspects or features of the claimed inventions. This response is not exhaustive; however, for the sake of brevity, these remarks focus on only some of the patentable features of the independent claim.

With that in mind, independent claim 27 describes a resonator comprising a spring-mass mechanism, having an effective mechanical stiffness and an effective mechanical mass defined by a geometry. The geometry and the effective mechanical mass of the spring-mass mechanism are simultaneously defined by application of a fabrication process to a constituent material. In addition, the geometry of the spring-mass mechanism is defined such that variations in the effective mechanical stiffness of the spring-mass mechanism are compensated by proportional changes in the effective mechanical mass of the spring-mass mechanism whereby one or more variations of the fabrication process to the constituent material results in little change to a ratio defined by a change in the effective mechanical stiffness and a change in the effective mechanical mass.

Adams Does NOT Anticipate the Claimed Inventions

Simply put, Adams does not anticipate the claimed invention. In this regard, the Adams resonator does not address any aspect of resonance frequency variations by process-tolerance-induced fabrication variations – for example, process-tolerance-induced undercut variations – via implementing a resonator having a geometry whereby process-tolerance-induced variations in the mechanical stiffness of a spring mechanism are compensated by proportional changes in a corresponding effective mass to provide a zero, near zero or predetermined ratio between the change in mechanical stiffness of the spring component and the change in the actual mass of the mass component. That is, Adams does not teach or suggest (expressly or inherently) a resonator having a geometry that is defined such that variations in the effective mechanical stiffness of the spring-mass mechanism are compensated by proportional changes in the effective mechanical mass of the spring-mass mechanism whereby one or more variations of the fabrication process to the constituent material results in little change to a ratio defined by a change in the effective mechanical stiffness and a change in the effective mechanical mass.

The Adams microelectromechanical device "preferably is fabricated in accordance with SCREAM-I process" which includes vents in the electrodes/beams to facilitate release of the moveable electrodes. (Adams, Col. 8, line 64 to Col. 9, line 22 and Figures 9 and 10). In the SCREAM-I process, during release of the beams/electrodes, "the side walls are also undercut to produce a concavity 124." (Adams, Col. 9, lines 16-18 and Figure 10). The geometry of the Adams spring-mass mechanism is not defined such that variations in the effective mechanical stiffness of the spring-mass mechanism are compensated by proportional changes in the effective mechanical mass of the spring-mass mechanism.

The Adams resonator system employs a bias voltage between the electrodes 70 and 84 and between adjacent electrodes 72 and 90 to compensate for processing variations. (Adams, Col. 8, lines 51-56). Indeed, "the electrostatic actuators ... provide a mechanism for electromechanically increasing or decreasing the stiffness and thus the resonant frequency of" the Adams resonator. In this way, Adams "compensate[s] for variations that can occur in the fabrication process." (Col. 1, lines 49-62).

Nowhere does Adams teach or suggest – expressly or inherently – to compensate for variations in spring-mass mechanism as the result of process-tolerance-induced errors by implementing a microelectromechanical resonator having a geometry that is defined as claimed (i.e., variations in the effective mechanical stiffness of the spring-mass mechanism are compensated by proportional changes in the effective mechanical mass of the spring-mass mechanism whereby one or more variations of the fabrication process to the constituent material results in little change to a ratio defined by a change in the effective mechanical stiffness and a change in the effective mechanical mass). Indeed, Adams appears to be relatively unconcerned with variations of the fabrication process to the constituent material of the resonator or with a ratio defined by a change in the effective mechanical stiffness and a change in the effective mechanical mass.

For at least the reasons set forth above, all of the currently pending claims are patentable over Adams. Notably, the reasons set forth below are *not* the only reasons the inventions of the independent claim are patentable over Adams, either alone or in combination with other art (whether such art is of record or not). As such, no inference or conclusion should be drawn that Applicants' response to this rejection is exhaustive; rather, for the sake of brevity, the remarks focus on some of the patentable aspects of the independent claim.[1]

Examiner's Response to Applicants' Arguments (Office Action, pp. 1-2)

Applicants note in paragraph 4 of the Office Action, the Examiner has purportedly addressed Applicants' arguments. Applicants are puzzled by the statement that such arguments have been fully considered but are not persuasive. The Examiner has simply quoted the Applicants' arguments without any analysis thereof -- for example, the Examiner has not explained why the Applicants' statements are in error, including the support in Adams as to why the Applicants' arguments are not persuasive.

Applicants are also puzzled as to the Examiner's support for his statement that:

> [t]he variations in the effective mechanical stiffness is compensated by proportional changes in the effective mechanical mass and also depends upon a ratio of width and height to provide substantial

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[1] As mentioned above, for the sake of brevity, this response does not present the additional reasons/bases that the dependent claims are patentable over Adams. However, for at least the reasons stated above, the dependent claims are not anticipated by Adams.

> rigidity and stiffness of the spring-mass mechanism. (Office Action, page 3, paragraph 4).

To the extent that the Examiner relies on his personal knowledge, Applicants respectfully request that the Examiner support his personal knowledge by affidavit pursuant to 37 CFR §104(d)(2). To the extent that the Examiner is relying upon Adams (expressly or inherently) for such comments, Applicants respectfully request that the Examiner quote the specific text in Adams or identify, with particularity, what/which feature(s) in the Adams drawings provide such support.

CONCLUSION

Applicants respectfully request reconsideration of the instant application and allowance of the claims. Notably, should a telephone interview expedite the prosecution of this application in any way, the Examiner is invited to contact the undersigned at the number listed below.

Respectfully submitted,

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